Appendix B

PATENT
Docket No.150.0065 0102

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Vaartstra et al.
Serial No.: 09/603,132
Confirmation No.: 3538
Filed: 23 June 2000

Group Art Unit: 2815
Examiner: E. Lee

For: DEVICE STRUCTURES INCLUDING RUTHENIUM SILICIDE DIFFUSION BARRIER LAYERS

DECLARATION UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

We, Brian A. Vaartstra and Eugene P. Marsh, declare and say as follows:

1. We are co-inventors of the subject matter claimed in the above-identified U.S. Patent Application Serial No. 09/603,132, filed 23 June 2000.

2. I, Brian A. Vaartstra, received a Ph.D. from University of Alberta in Alberta Canada, in 1989. I have been employed at Micron Technology, Inc. since 1995.

3. My research activities include, but are not limited to, research and development of vapor deposition of thin films, including chemical vapor deposition.

4. I, Eugene P. Marsh, received a Ph.D. from the University of California Santa Barbara in Santa Barbara, California, in 1989. I have been employed at Micron Technology, Inc. since 1995.

5. My research activities include, but are not limited to, research and development of vapor deposition of thin films, including chemical vapor deposition.

6. We have read and are familiar with the Office Action mailed 25 November 2002, which substantially restates the rejections previously set forth in the Office Action mailed 18 June 2002, with respect to the above-identified application. We have also read and are familiar with Matsubara et al. (U.S. Pat. No. 5,122,923) and Kuroiwa et al. (U.S. Pat. No. 6,239,460 B1). We make this Declaration in support of the patentability of the claims of patent application Serial No. 09/605,132.

7. We submit there are significant structural differences between a sputter coated diffusion barrier layer and a chemical vapor deposited diffusion barrier layer.

8. The structural differences between a sputter coated diffusion barrier layer and a chemical vapor deposited diffusion barrier layer include different layer coverage on surfaces having complex geometries. For example, sputter coating a contact hole having a high aspect ratio would typically result in a disproportionately thicker layer of material developing around the opening of the hole as compared to the other surfaces surrounding or within the hole. As a result, the sputter coated diffusion barrier layer may be unable to completely coat the walls and/or the bottom of the contact hole. This would leave regions of the contact hole either not coated or inadequately coated.

In contrast, chemical vapor deposited diffusion barrier layers provide highly conformal and uniform layer coverage on surfaces. This is especially true with respect to surfaces having complex geometries. As such, chemical vapor deposited diffusion barrier layers are more conformal and uniform on surfaces having complex geometries (e.g., contact holes) than a

sputter coated diffusion barrier layer.

9. The structural differences between a sputter coated diffusion barrier layer and a chemical vapor deposited diffusion barrier layer also include differences in the resulting film and substrate qualities. For example, sputter coated diffusion barrier layers can have a high pinhole count as compared to chemical vapor deposited diffusion barrier layers. Also, there is limited stress control possible with sputter coated diffusion barrier layers as compared to chemical vapor deposited diffusion barrier layers.

In addition, an underlying substrate to a sputter coated diffusion barrier layer may have surface damage. This surface damage caused by the sputter coating technique may include implantation of metal into the underlying substrate. For example, ruthenium can be implanted into a silicon substrate surface during the sputter coating of $RuSi_x$. The implanted ruthenium can then diffuse into the silicon substrate. In addition, silicon can be implanted into platinum surfaces during sputter coating of $RuSi_x$ where the silicon can diffuse into the platinum containing substrate. Either example of diffusion into the underlying substrate provides a structural difference between a sputter coated diffusion barrier layer and a chemical vapor deposited diffusion barrier layer.

10. In view of the above, our conclusion is that sputter coated diffusion barrier layers and chemical vapor deposited diffusion barrier layers have different structures. As such if a chemical vapor deposited diffusion barrier layer and a sputter coated diffusion barrier layer were analyzed by one skilled in the art these structural differences, as described above, would allow one skilled in the art to identify the diffusion barrier layer as either being a sputter coated diffusion barrier layer or a diffusion barrier layer having been deposited by a different technique (e.g., chemical vapor deposited diffusion barrier layer).

11. We further declare that statements made herein of our knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: 01/23/2003 By: _____

Brian A. Vaartstra

Dated: 1/23/2003 By: _____

Eugene P. Marsh